C

2500/405

NATIONAL QUALIFICATIONS 2001

WEDNESDAY, 16 MAY
1.30 PM – 2.25 PM

MATHEMATICS
STANDARD GRADE
Credit Level
Paper 1
(Non-calculator)

1 **You may NOT use a calculator.**

2 Answer as many questions as you can.

3 Full credit will be given only where the solution contains appropriate working.

4 Square-ruled paper is provided.

SCOTTISH QUALIFICATIONS AUTHORITY

FORMULAE LIST

The roots of $ax^2 + bx + c = 0$ are $x = \dfrac{-b \pm \sqrt{(b^2 - 4ac)}}{2a}$

Sine rule: $\dfrac{a}{\sin A} = \dfrac{b}{\sin B} = \dfrac{c}{\sin C}$

Cosine rule: $a^2 = b^2 + c^2 - 2bc \cos A$ or $\cos A = \dfrac{b^2 + c^2 - a^2}{2bc}$

Area of a triangle: Area $= \frac{1}{2}ab \sin C$

Volume of a cylinder: Volume $= \pi r^2 h$

Standard deviation: $s = \sqrt{\dfrac{\Sigma(x - \bar{x})^2}{n-1}} = \sqrt{\dfrac{\Sigma x^2 - (\Sigma x)^2 / n}{n-1}}$, where n is the sample size.

	KU	RE

1. Evaluate

$$3{\cdot}1 + 2{\cdot}6 \times 4.$$

2

2. Evaluate

$$3\tfrac{5}{8} + 4\tfrac{2}{3}.$$

2

3. **Given that** $f(m) = m^2 - 3m$, evaluate $f(-5)$.

2

4. Solve **algebraically** the equation

$$2x - \frac{(3x-1)}{4} = 4.$$

3

5. A furniture maker investigates the delivery times, in days, of two local wood companies and obtains the following data.

Company	*Minimum*	*Maximum*	*Lower Quartile*	*Median*	*Upper Quartile*
Timberplan	16	56	34	38	45
Allwoods	18	53	22	36	49

(*a*) Draw an appropriate statistical diagram to illustrate these two sets of data.

3

(*b*) Given that consistency of delivery is the most important factor, which company should the furniture maker use? Give a reason for your answer.

1

[Turn over

KU	RE

6. A is the point (a^2, a).

T is the point (t^2, t), $a \neq t$

Find the gradient of the line AT.

Give your answer in its simplest form. **3**

7. A garage carried out a survey on 600 cars.

The results are shown in the table below.

		Engine size (cc)			
		0–1000	1001–1500	1501–2000	2001+
Age	Less than 3 years	50	80	160	20
	3 years or more	60	100	120	10

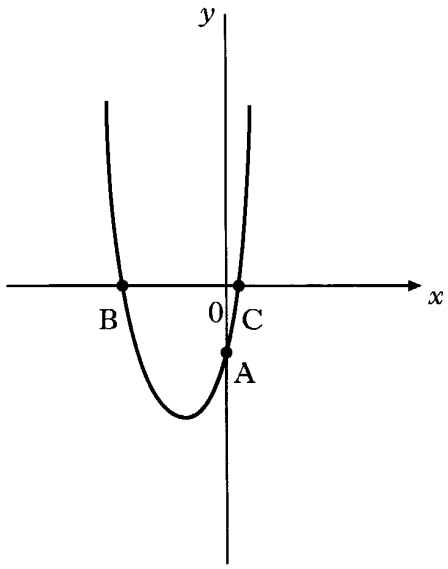
(*a*) What is the probability that a car, chosen at random, is less than 3 years old? **1**

(*b*) In a sample of 4200 cars, how many would be expected to have an engine size greater than 2000cc **and** be 3 or more years old? **2**

	KU	RE

8. The diagram below shows part of the graph of $y = 4x^2 + 4x - 3$.

The graph cuts the y-axis at A and the x-axis at B and C.



(*a*) Write down the coordinates of A. **1**

(*b*) Find the coordinates of B and C. **3**

(*c*) Calculate the minimum value of $4x^2 + 4x - 3$. **2**

9. A number pattern is shown below.

$$1^3 + 1 = (1 + 1)(1^2 - 1 + 1)$$
$$2^3 + 1 = (2 + 1)(2^2 - 2 + 1)$$
$$3^3 + 1 = (3 + 1)(3^2 - 3 + 1)$$

(*a*) Write down a similar expression for $7^3 + 1$. **1**

(*b*) Hence write down an expression for $n^3 + 1$. **1**

(*c*) Hence find an expression for $8p^3 + 1$. **2**

[Turn over

	KU	RE
10. Simplify $\frac{\sqrt{3}}{\sqrt{24}}$. Express your answer as a fraction with a rational denominator.	**3**	
11. The intensity of light, I, emerging after passing through a liquid with concentration, c, is given by the equation $I = \frac{20}{2^c} \quad c \geq 0.$		
(*a*) Find the intensity of light when the concentration is 3.	**1**	
(*b*) Find the concentration of the liquid when the intensity is 10.	**2**	
(*c*) What is the maximum possible intensity?		**3**

[END OF QUESTION PAPER]

C

2500/406

NATIONAL QUALIFICATIONS 2001

WEDNESDAY, 16 MAY
2.45 PM – 4.05 PM

MATHEMATICS STANDARD GRADE

Credit Level
Paper 2

1 **You may use a calculator.**

2 Answer as many questions as you can.

3 Full credit will be given only where the solution contains appropriate working.

4 Square-ruled paper is provided.

SCOTTISH QUALIFICATIONS AUTHORITY

LIB 2500/406 6/36620

FORMULAE LIST

The roots of $ax^2 + bx + c = 0$ are $x = \dfrac{-b \pm \sqrt{(b^2 - 4ac)}}{2a}$

Sine rule: $\dfrac{a}{\sin A} = \dfrac{b}{\sin B} = \dfrac{c}{\sin C}$

Cosine rule: $a^2 = b^2 + c^2 - 2bc \cos A$ or $\cos A = \dfrac{b^2 + c^2 - a^2}{2bc}$

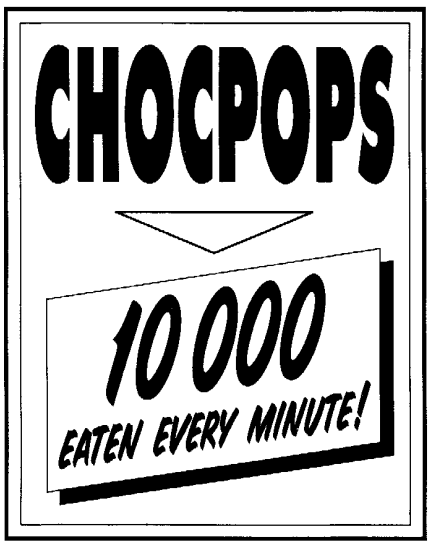
Area of a triangle: Area $= \frac{1}{2}ab \sin C$

Volume of a cylinder: Volume $= \pi r^2 h$

Standard deviation: $s = \sqrt{\dfrac{\Sigma(x - \bar{x})^2}{n - 1}} = \sqrt{\dfrac{\Sigma x^2 - (\Sigma x)^2 / n}{n - 1}}$, where n is the sample size.

	KU	RE

1.



How many chocpops will be eaten in the year 2001?

Give your answer in **scientific notation**. **2**

2. The price, in pence per litre, of petrol at 10 city garages is shown below.

84·2	84·4	85·1	83·9	81·0
84·2	85·6	85·2	84·9	84·8

(*a*) Calculate the mean and standard deviation of these prices. **3**

(*b*) In 10 rural garages, the petrol prices had a mean of 88·8 and a standard deviation of 2·4.

How do the rural prices compare with the city prices? **2**

3. In 1999, a house was valued at £90 000 and the contents were valued at £60 000.

The value of the house **appreciates** by 5% each year.

The value of the contents **depreciates** by 8% each year.

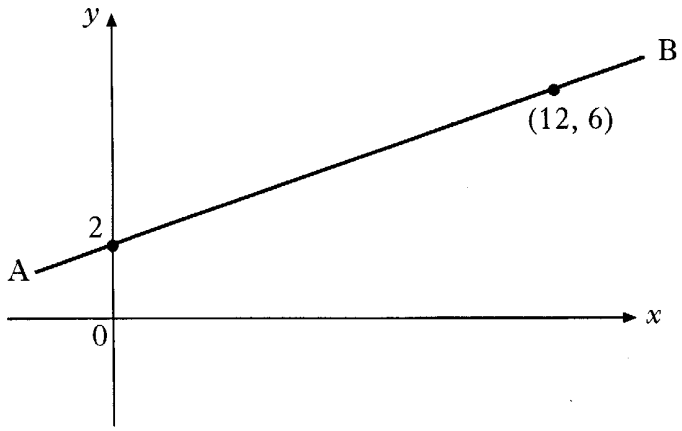
What will be the **total** value of the house **and** the contents in 2002? **3**

[Turn over

KU	RE

4. A water pipe runs between two buildings.

These are represented by the points A and B in the diagram below.



(*a*) Using the information in the diagram, show that the equation of the line AB is $3y - x = 6$. **3**

(*b*) An emergency outlet pipe has to be built across the main pipe. The line representing this outlet pipe has equation $4y + 5x = 46$.

Calculate the coordinates of the point on the diagram at which the outlet pipe will cut across the main water pipe. **4**

5. A cylindrical soft drinks can is 15 centimetres in height and 6·5 centimetres in diameter.

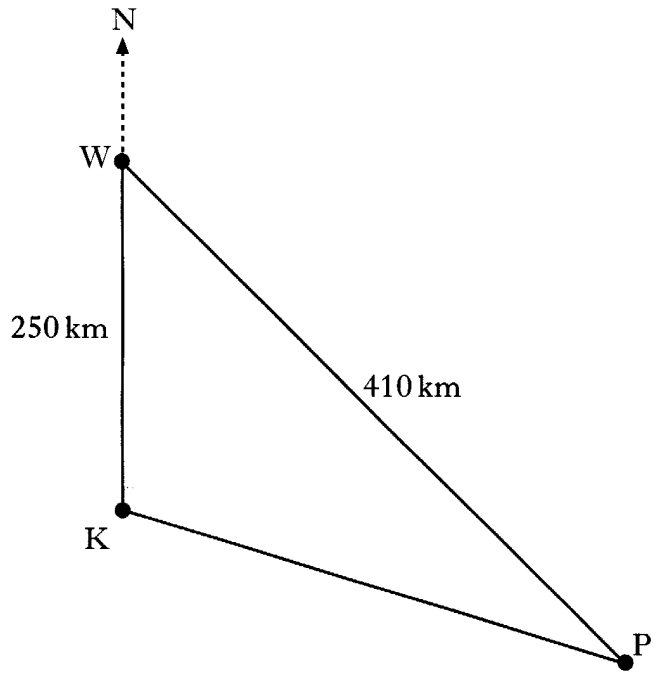
A new cylindrical can holds the same volume but has a reduced height of 12 centimetres.

What is the diameter of the new can?

Give your answer **to 1 decimal place**. **4**

KU	RE

6. Three radio masts, Kangaroo (K), Wallaby (W) and Possum (P) are situated in the Australian outback.



Kangaroo is 250 kilometres due south of Wallaby.

Wallaby is 410 kilometres from Possum.

Possum is on a bearing of 130° from Kangaroo.

Calculate the bearing of Possum from Wallaby.

Do not use a scale drawing. 4

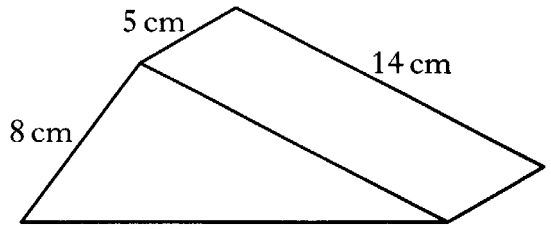
7. Solve **algebraically** the equation

$$\tan 40° = 2\sin x° + 1 \qquad 0 \leq x < 360.$$ 3

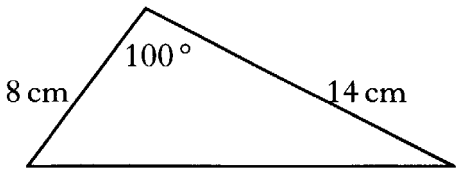
[Turn over

KU	RE

8. A metal door-stop is prism shaped, as shown.



The uniform cross-section is shown below.



Find the volume of metal required to make the door-stop. **4**

9. The electrical resistance, R, of copper wire varies directly as its length, L metres, and inversely as the square of its diameter, d millimetres.

Two lengths of copper wire, A and B, have the same resistance.

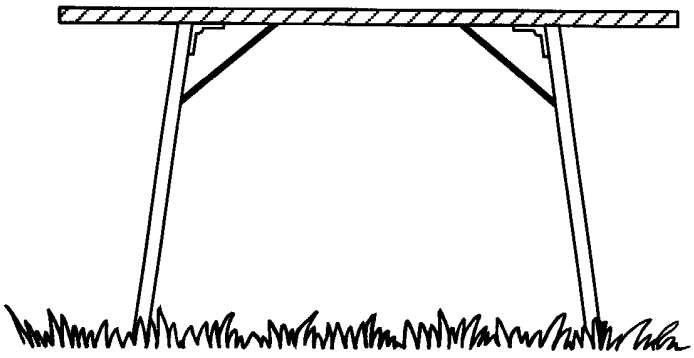
Wire A has a diameter of 2 millimetres and a length of 3 metres.

Wire B has a diameter of 3 millimetres.

What is the length of wire B? **4**

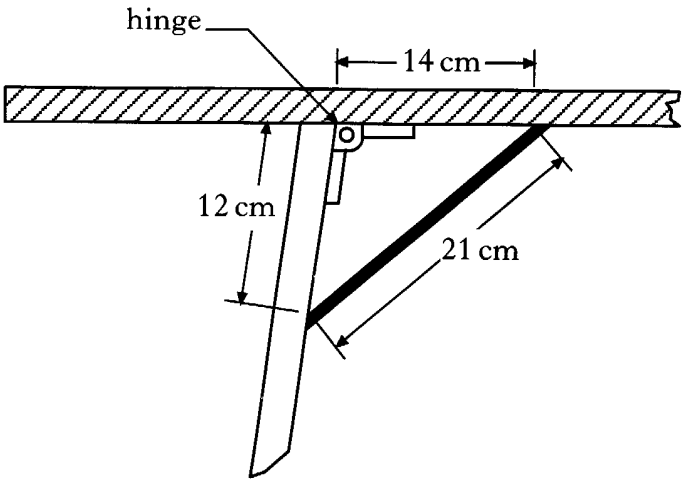
KU	RE

10. Each leg of a folding table is prevented from opening too far by a metal bar.



The metal bar is 21 centimetres long.

It is fixed to the table **top** 14 centimetres from the hinge and to the table **leg** 12 centimetres from the hinge.



(*a*) Calculate the size of the obtuse angle which the table top makes with the leg. **3**

(*b*) Given that the table leg is 70 centimetres long, calculate the height of the table. **3**

[Turn over for Question 11 on *Page eight*

KU	RE

11. A rectangular wall vent is 30 centimetres long and 20 centimetres wide.

It is to be enlarged by increasing **both** the length and the width by x centimetres.

(*a*) Write down the length of the new vent. **1**

(*b*) Show that the area, A square centimetres, of the new vent is given by

$$A = x^2 + 50x + 600.$$ **2**

(*c*) The area of the new vent **must** be **at least** 40% more than the original area.

Find the **minimum** dimensions, to the nearest centimetre, of the new vent. **5**

[END OF QUESTION PAPER]